B. MIGRATION TIMING

1. Methods.

The distribution of daily passage indices for a particular species at a monitoring site provides a measure of migration timing. Plots of the passage distributions for each species at the Snake River (Lewiston) trap and Lower Granite, Rock Island, McNary, John Day, and Bonneville (powerhouses 1 and 2) dams are presented in Appendix E in a format that is unchanged from previous years.

Estimates of the 10%, 50% and 90% passage dates for each species were computed from the cumulative passage distributions at each monitoring site. The duration of the migration for each species at a project was computed as the number of days between the 10% and 90% passage dates. The dates of 10%, 50%, and 90% passage for each species and monitoring site from previous years

were ordered in an ascending sequence for each percentile. The median date from sequences provided historical 10%, 50%, and 90% passage dates for comparison with the 1990 data. A theoretical 80% passage duration from the historical record was computed by subtracting the historical 10% date from the historical 90% date. Wild and hatchery steelhead migration timing for 1990 was compared with 1989 timing data (the first year hatchery and wild steelhead passage data were separated). Changes from the historical data cannot be considered in isolation of other influential factors, such as different hatchery release schedules, changing flow patterns, and project operational differences. In addition, the unplanned barge release above John Day Dam on May 30, required that an estimate of barged fish be removed from the June 2-3 passage indices at Bonneville Dam before computation of the 10, 50, and 90% passage dates at that site.

A series of graphs (Appendix F) were generated for the migration timing of the middle 80% of smolt runs of known hatchery origin. The dates of 10% and 90% passage for marked groups of yearling and subyearling chinook and steelhead were estimated from the cumulative passage index distributions, following pooling of replicate releases for each hatchery group of interest. For the lower Columbia River monitoring sites, several marked groups from the same drainage were pooled to increase sample size and allow timing information for fish from that particular drainage. The migration timing of the middle 80% of each mark group was plotted between the 10 and 90% dates.

2. Results and Discussion.

The timing of smolt entry into Lower Granite reservoir was provided by monitoring at the Clearwater and Snake River traps, located near Lewiston, Idaho. Clearwater River trap collections began to increase on March 22 for yearling chinook and April 4 for steelhead, with peak passage on April 6 for chinook and on May 5 for steelhead. These peaks were within 24-48 hours after large production releases from Dworshak Hatchery. Sampling was terminated during periods of high flow at the Clearwater River trap. Snake River trap collections began to increase on March 25 for yearling chinook and on April 16 for steelhead, with the first peak of passage on April 24 for chinook and on May 7 for steelhead, at a time of increasing flow. The second peak day of passage occurred on May 30 for both species, the date of the highest Snake River flow for the 1990 season. Snake River trap collections dropped to negligible levels after June 5 for yearling chinook and after June 13 for steelhead.

The 10%, 50%, and 90% dates of passage and duration of the middle 80% of the run for each species at Lower Granite, Rock Island, McNary, and Bonneville dams are presented in Table 11. Only approximate 10% and 50% dates for spring migrants are presented for John Day Dam, because of the 11-day outage of Unit 5 late in the spring season. Likewise, no passage percentile dates are given for subyearling chinook at John Day Dam due to several outages of Unit 5 during the summer

Table 11. 1990 and historical passage dates for juvenile salmonids at key monitoring sites.

Site	Species	1990 Passage Dates 10%	50%	90%	80% Passage Duration(days)	Historical Passage Dates 10%	50%	90%	80% Passage Duration(days)
LOWER GRANITE	YRLG CHINOOK	04/16	04/24	05/21	35	04/18	04/28	05/25	37
	STEELHEAD	04/26	05/12	06/01	36	04/28	05/13	06/01	34
	SOCKEYE	04/11	05/24	06/23	73	NA	NA	NA	-
ROCK ISLAND DAM	YRLG CHINOOK	04/19	04/29	05/15	26	04/24	05/07	05/22	28
	SUBYR CHINOOK	06/03	06/30	07/31	58	06/09	07/04	08/03	55
	STEELHEAD	04/26	05/11	06/02	37	05/08	05/16	05/29	21
	COHO	05/07	05/18	05/29	22	05/14	05/21	05/28	14
	SOCKEYE	04/18	05/02	06/03	46	04/19	05/01	05/23	34
MCNARY DAM	YRLG CHINOOK	04/23	05/09	05/23	30	04/21	05/10	05/24	33
	SUBYR CHINOOK	06/14	06/26	07/20	36	06/16	07/06	07/21	35
	STEELHEAD	04/29	05/15	06/02	34	04/30	05/18	06/01	32
	COHO	04/23	05/14	05/26	33	05/18	05/23	06/02	15
	SOCKEYE	04/28	05/12	06/03	36	05/02	05/18	06/03	32
JOHN DAY DAM	YRLG CHINOOK	04/25	05/10	NA	-	04/28	05/15	05/30	32
	SUBYR CHINOOK	NA	NA	NA	-	06/08	07/21	09/01	85
	STEELHEAD	04/29	05/07	NA	-	04/26	05/15	05/31	35
	COHO	04/27	05/05	NA	-	05/06	05/13	05/31	25
	SOCKEYE	05/04	05/15	NA	-	05/10	05/22	06/04	25
BONNEVILLE PH#1	YRLG CHINOOK	04/16	05/02	05/22	36	04/19	05/01	05/21	32
	SUBYR CHINOOK	04/21	06/23	07/08	78	NA	NA	NA	-
	"BRIGHTS"	06/07	06/27	07/12	35	06/08	06/29	07/31	53
	STEELHEAD	05/01	05/14	06/04	34	04/26	05/13	05/29	33
	COHO	04/23	05/09	06/09	47	05/01	05/10	05/29	28
	SOCKEYE	05/08	05/22	06/05	28	05/11	05/24	06/04	24

- Historical percentiles are based on passage data for 6 years (1984-89) at Lower Granite and McNary dams, 5 years (1985-89) at Rock Island Dam, 4 years at John Day Dam, and 3 years (1987-89) at Bonneville Dam for spring migrants and 2 years (1988-89) for summer migrants.
- Outages of Unit 5 at John Day Dam during the periods April 16-19, May 30-June 10, June 21-23, and August 13-16 make computed percentiles gross approximations only. It is likely that dates would be up to several days later if uninterrupted sampling had occurred. Dates where not even a gross estimation is feasible are denoted by "NA".
- "Brights" at Bonneville Dam refers to subyearling chinook arriving after June 1; this excludes most "tule" fall chinook originating from Spring Creek Hatchery.
- An unplanned barge release of approximately 600,000 yearling chinook and steelhead above John Day Dam on May 30 resulted in an excess of about 75,000 steelhead and 5,000 yearling chinook in the Bonneville Dam passage index for June 2 and 3. The estimated extra barged fish were subtracted from the June 2-3 passage indices at Bonneville Dam before computation of 10, 50, and 90 percent passage dates.

migration season, and the overall low collections of subyearling chinook. At all five monitoring sites, there was a tendency for the first half of the passage distributions of most species to be shifted earlier in 1990 from the previous years of the SMP. The average difference between the 1990 dates of 50% passage and the historical dates, averaged across all species and sites, was 4 days earlier in 1990. Exceptionally early 10% passage dates were observed in 1990 compared to the historical dates for steelhead at Rock Island Dam (12 days early) and coho at McNary Dam (25 days early), the latter simply reflecting an earlier migration of coho out of the Yakima River drainage. Even though the 10% and 50% dates of the migrations appeared to shift earlier, the 90% passage dates were often

within one day of the historical 90% day, and seldom further than a week away. The largest deviations between 1990 and historical 90% dates occurred for sockeye at Rock Island Dam and coho at Bonneville Dam (11 days later in 1990), and for subyearling chinook, predominantly "upriver brights", at Bonneville Dam (19 days earlier in 1990). There has been a tendency toward earlier 90% dates at Rock Island Dam, with the weakening Osoyoos run of sockeye in recent years. However, the rapid increase in flow beginning May 30 resulted in a corresponding rise in passage indices later in the season for the sockeye at Rock Island Dam as well as coho at Bonneville Dam (Appendix Figures E-3 and E-7), contributing to the later date of 90% passage this year. The high flow in June and the early half of July substantially increased the number of upriver brights chinook passing Bonneville Dam this year. The higher than usual passage indices in June and early July, and the return to lower summer flows after mid-July, together appear to contribute to the 20-day earlier 90% date at Bonneville Dam this year. As a result of uncommon 10% and/or 90% dates, the middle 80% durations for steelhead and sockeye at Rock Island Dam and coho at all Columbia River sites were 8 to 18 days longer than the historical duration, and the middle 80% duration for upriver brights chinook at Bonneville Dam was 19 days shorter. The remaining cases had middle 80% durations differing by less than five days from that of the historical period.

Differences in migration timing between wild and hatchery steelhead past the monitoring sites are evident from Table 12. There was a trend for the first half of the passage distribution of wild steelhead to be skewed earlier than hatchery steelhead. However, the 90% passage dates of wild and hatchery steelhead were very similar. This resulted in wild steelhead having a longer duration of the middle 80% of the run at each monitoring site.

Appendix F graphically presents the middle 80% migration timing of marked hatchery groups of yearling chinook, subyearling chinook and steelhead at key monitoring sites between Lower Granite Dam and Bonneville Dam for Snake River stocks and between Rock Island Dam and Bonneville Dam for mid-Columbia River stocks. The first yearling chinook hatchery group to pass Lower Granite Dam was spring chinook from Lookingglass Hatchery, followed by spring chinook from Imnaha River acclimation pond, and Rapid River, Sawtooth, and Dworshak hatcheries. Summer chinook from McCall Hatchery begin arriving during the later half of the spring chinook migration and extend over a five week period, coincident with the steelhead migration. At McNary Dam, the middle 80% passage of most marked yearling chinook from the Snake River and mid-Columbia River hatcheries occurred between April 27 and May 27 this year. Dworshak and McCall hatchery chinook passage extended later, while Ringold Hatchery spring chinook had a distinct passage period during the first three weeks of April. The migration timing of Ringold Hatchery fish remained distinctively earlier at John Day and Bonneville dams as well. Marked steelhead from Oregon tributaries were

Table 12. Hatchery and wild steelhead passage dates for 1990 compared to 1989 at key monitoring sites.

		1990				1989			
		Passage Dates			80% Passage	Passage Dates			80% Passage
Site	Category	10%	50%	90%	Duration(days)	10%	50%	90%	Duration(days)
LOWER GRANITE	WILD	04/21	05/09	05/30	39	04/22	05/09	05/29	37
	HATCHERY	04/28	05/12	06/01	34	04/30	05/11	06/02	33
ROCK ISLAND DAM	WILD	04/21	05/14	06/06	46	04/28	05/16	06/07	40
	HATCHERY	04/27	05/10	05/31	34	05/10	05/17	06/05	26
MCNARY DAM	WILD	04/22	05/08	06/02	41	04/24	05/14	05/24	30
	HATCHERY	05/02	05/16	06/02	31	05/04	05/19	05/29	25
JOHN DAY DAM	WILD	04/26	05/03	NA	NA	04/18	05/09	05/23	35
	HATCHERY	05/02	05/13	NA	NA	05/08	05/18	05/28	20
BONNEVILLE PH#1	WILD	04/30	05/09	06/02	33	04/20	05/10	05/29	39
	HATCHERY	05/01	05/18	06/05	35	04/27	05/15	05/29	32

- Outages of Unit 5 at John Day Dam during the periods April 16-19 and May 30 - June 10 make computed percentiles gross approximations only. It is likely that dates would be up to several days later if uninterrupted sampling had occurred.

- An unplanned barge release of juvenile salmonids above John Day Dam on May 30 resulted in excess of about 75,000 steelhead in the Bonneville Dam passage index. An estimate of 8,000 wild and 67,000 hatchery steelhead (barge fish) were excluded from the June 2 and 3 passage indices before computation of the 10, 50, and 90 percent passage dates.

the first to arrive at Lower Granite Dam, followed by marked steelhead from Idaho hatcheries. The middle 80% durations of most marked steelhead groups ranged from 3 to 5½ weeks (the Lyons Ferry Hatchery release in Asotin Creek was only 2 weeks). At McNary Dam, marked steelhead from the mid-Columbia River drainage had a compact middle 80% passage duration of 2 weeks, compared to the 2½-4½ week duration of marked steelhead from the drainages of the Snake and Walla Walla rivers. The more compact passage duration of marked mid-Columbia River steelhead continued downstream at John Day and Bonneville dams. The middle 80% passage period for subyearling chinook of hatchery origin occurred at the peak period of subyearling chinook passage at each monitoring site from Rock Island Dam to Bonneville Dam between early June and mid-July. The summer migration after mid-July was composed of mostly subyearling chinook of wild origin. Pre-summer peaks of subyearling passage at Bonneville Dam were dominated by non-branded fish from hatcheries in Bonneville pool, particularly Spring Creek Hatchery.

3. Conclusions.

Peaks in chinook and steelhead passage at the Idaho traps followed large hatchery releases upstream of the Clearwater trap and large increases in flow at the Snake River trap. The migration timing of most species at the monitoring sites averaged about four days earlier this year compared to the historical median dates of 10, 50, and 90% passage. Generally, the duration of the middle 80% of the species run at a monitoring site differed by less than five days from the historical duration. The most notable exception was the earlier 90% date of upriver bright chinook at Bonneville Dam,

and subsequent 19-day shorter middle 80% duration. The large number of upriver bright chinook passing Bonneville Dam during the period of high flow in June and early July resulted in an early 90% date this year.